Gesture-Based Mouse Controller - Summary Report

# 1. Introduction

This project implements a computer vision-based mouse controller using hand gestures, leveraging the MediaPipe hand tracking model, OpenCV for image capture and display, and pynput for simulating mouse movements and clicks. It allows users to interact with their computer using intuitive hand gestures via webcam.

# 2. Tools and Libraries Used

- Python  
- OpenCV (cv2) for video capture and image processing  
- MediaPipe for hand tracking and gesture recognition  
- pynput for controlling mouse actions  
- NumPy for mathematical operations  
- Tkinter (optional) for screen dimension retrieval

# 3. Features and Gestures

- Move cursor by moving index finger  
- Single click: Pinch index finger and thumb  
- Double click: Two rapid pinches  
- Scroll down: Pinch middle finger and thumb  
- Scroll up: Pinch ring finger and thumb  
- Cursor movement smoothing and stability detection to reduce jitter

# 4. Implementation Highlights

- Hand landmarks are extracted using MediaPipe  
- Cursor movement is smoothed with a filter to avoid jitter  
- Gesture recognition is based on Euclidean distance between fingers  
- Clicks and scrolling actions are determined based on pinching gestures  
- Visual feedback is provided on screen via OpenCV overlays

# 5. Running the Application

1. Install the required dependencies using pip:  
 pip install -r requirements.txt  
  
2. Ensure your Python version is compatible (preferably Python 3.11 or lower).  
  
3. Run the script in a terminal or IDE:  
 python your\_script\_name.py  
  
4. Use gestures in front of the webcam to control the cursor.  
 Press 'q' to quit.

# 6. Dataset

This application does not rely on an external dataset. It uses real-time video feed from the camera and processes each frame live using MediaPipe's hand tracking model.